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JOB SAFETY ASSESSMENT OF WOODWORK INDUSTRY IN THE SOUTHWESTERN NIGERIA

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Abstract
This study carried out a job safety assessment of 23 woodwork industry in Southwest Nigeria. Using detailed analytical-descriptive survey involving 310 woodworkers, assessment was carried out through interview and Job Safety Analysis (JSA).85.5% of total response have suffered injuries. Manual lifting (99.2%), forceful gripping (97.3%), wood dust (78.6%) and hazardous substances (75.4%) were the reported common risk factors with some causal link between operations, as finishing (70.8%), planning/scrapings (63.3%), hammering (57.5%), and work-related injuries. The JSA team rated high (67%-90%) the risk of; environmental hazards, caught-in-moving parts, bruises/cuts, hazardous substance inhalation. Improper dressing and personal protective equipment inadequacy were rated 80% and 74% respectively. Risk priority number gain showed; dust, clamp spindle, pinch-point, rotating blade, hammer head, nail, chemicals as most prior risks. The JSA provided knowledge based tool of the likelihood of hazards, causes, consequences and recommended procedures to eradicate hazards and enhances occupational health and safety of the workers.

Keywords: woodworking, hazard, safety, operation, analysis, workers.

1. Introduction

Woodworking is a job that entails physical attributes connected with making of items from wood. Its activities include cabinet making, wood carving, joinery and carpentry. According to European Federation of Building and Woodworkers (European Federation of Building and Woodworkers, 2015), the woodworking industry is a major employer reported to provide jobs to about2.3 million people in the European Union in 2013.The companies within the industry are mostly small and medium-sized enterprises, with only a few large groups.

Woodwork industry is among the highest ranked small-scale industries with high risks of occupational injuries (Nakata *et al.*, 2006).Hazards and injuries associated with woodworking include; mechanical such as being caught-in or struck by machinery; chemical such as breathing in toxic chemicals like wood dust, as well as physical such as noise pollution (Aruofor, 2000; Judd and Janice, 2004). Workers in the industry suffer common injuries like laceration, amputation, severed fingers, and blind-ness. Wood dust and the chemicals used in finishing operation are health hazards, and workers exposed to these hazards can suffer from skin and respiratory diseases (U.S. Department of Labour Occupational Safety and Health Administration, 1999).

As reported by the African Newsletter on Occupational Health and Safety (2009), out of the 825 accidents reported by 26 wood-processing enterprises, the proportion of injuries linked to wood processing was 21.5%. In this group, 24.2% of woodworkers were injured in 2007 and 19.3% in 2008. The largest body regions affected were the upper extremities including head, neck and the lower extremities. In a study related to safety practices and injuries associated with wood processing in a timber company in Ghana, headaches, respiratory problems, small cuts, back pains, and hip and leg pains were reported (Mitchual and Donkoh, 2015).

According to Oluwatosin, *et al.*, (2015), in some parts of western Nigeria, report have shown that lots of manual handlings, common in the woodworking operations, exposed workers to high levels of risks such as respiratory disorder symptoms (cough, chest pain sputum production), conjunctivitis, skin irritation and hearing difficulties. In a study to evaluate the pattern of hand injuries among sawmill workers, cuts accounted for 38.6% followed by pain and swelling (Bamidele, *et al., 2011).* Segun, *et al.* (2010) highlighted various injuries to body parts including upper limb (neck and head, arm, wrist, hand and shoulder), back and lower back injuries, and less prominent lower limb (Legs, knees and ankle) injuries.

It was mentioned that many workers involved in jobs that required physical activities are very ignorant of safety measures (Adeyemi, 2013). Most safety programs however are considered reactive, an action in response to incident. Hazards in work places should be recognized as early as possible with preventive measures implemented at the planning and organizing stages. Job Safety Analysis (JSA) is one of such measures considered an active approach to workplace safety (Canadian Centre for Occupational Health and Safety and Human Resources, 2001; Canadian Centre for Occupational Health & Safety, 2016; Texas Department of Insurance, 2006). JSA is a safety management technique that focused on and is used to identify and control the hazards associated with a job or task. It is a proven tool used to improve job safety. It ascertains the hazards existing between the worker and work environment (tools, tasks, place, etc.). The analysis can be performed for all jobs, whether non-routine, routine or one-step-jobs. The purpose of setting up JSA team by the management of any workplace is to lower the risk in each step of a job. The team takes some specific steps, which include: involvement of employees for their unique understanding of the job that is invaluable for finding hazards; reviewing of the workplace accident history to show employees' worksite's history of accidents and occupational illnesses; conducting a preliminary job review by discussing with the employees of the hazards they know exist in their current work and surroundings; list, rank, and set priorities for hazardous jobs; watch the employee perform the job, outline the steps and break it down; brainstorming to come up with measures adoptable to eradicate or minimize the hazards (Occupational Safety & Health Administration, 2010).

With many illiterate/semi-illiterate employees widely involved in small and/or medium scale industry in western part of Nigeria, and needed to be adequately informed, the present study set out at conducting safety assessment in woodworking industry with the objectives to; review the type and the prevalence of work related hazards/injuries among the group of workers, evaluate the risk factors and the operation steps mostly contributing to injuries in the task, conduct JSA and provisions of measures to minimise the hazards.

2. Materials and Methods

2.1 Study Area, Design and Task

This study used analytical-descriptive survey to inspect hazards in cabinet making and some joinery jobs in 23 woodworking industries situated in the Southwest part of Nigeria. The research involved 310 subjects (workers and supervisors). The JSA team pointed out to the subjects involved on the reason for the studying. They were assured that the study was not to check on their job performance and their consents were clearly received. It adopted three stages as reported by Chao and Henpshaw (2002) which included: breaking the task down into a sequence of stages and

identifying all possible hazards connected to them; evaluating the level of risk and risk factors for all the identified hazards and; deliberating on measures at reducing or eliminating the risk.

2.1.1 Jobs Observation and Breakdown

The tasks were observed as they were performed. Each step-by-step sequence of the work was followed and the types of risk involved were recorded.

2.1.2 Identification of Job-Related risks

JSA team focused attention, by observation, on the risk involved in the performance of the task and situations in the working environment. Some other related risks were also identified by checking the job lists. Scores were allocated (5=strongly prevalent, 3 = prevalent, 1= limited and 0 = insignificant) to hazards for each risk of the task.

Workers and supervisors performing the job were also interviewed, using questionnaires, on the events and semi previous events related with hazards prevalence on the job. The subjects were asked, to report injury prevalence as experienced on the job and indicate their level of agreement (5= strongly agree, 3 = agree, 1 = disagree, 0 = strongly disagree) to the various job operations opined to have led to the reported injuries and the possible risk factors.

2.1.3 Deliberation on Measures to Reduce or Eliminate Risk

All identified job-related risks were mentioned, checked and their risk priority number (RPN) determined during brainstorming sessions which involved three (3) ergonomics professionals drawn from academic environment. Whether the job could be performed in another way to eliminate the hazards were discussed and determined. The relevance of possible physical changes such as safety equipment, Personal Protective Equipment (PPE) and precautions needed to control the hazards were also looked into.

2.1.3.1 Determination of Risk Priority Number

The Risk Priority Number (RPN), a numeric assessment of risk assigned to steps in a process that quantify likelihood of occurrence (how long it takes to recover functionality), likelihood of detection (possible to quickly spot the danger when it occurs), and severity of impact (reflects the negative consequence to the workers). As guided by Carnegic Mellon University (2002), the JSA team assigned corresponding numeric values, as shown in Figure 1, that quantify likelihood of occurrence, likelihood of detection and severity of impact.

Table 1: Risk Priority Number for assessment of risk assigned to woodwork steps

Numeric Values	Likelihood of Occurrence	Likelihood of Detection	Severity of Impact
1	Under 10 hours to recover	There is an explicit alert	Increases worker's workload slightly
2	Less than a week to recover,	Worker will always notice the malfunction	Increases worker's workload significantly
3	About a week to recover	Worker will notice malfunction only after other functions	Could limit/delay operations
4	Week to months to recover	May detect symptoms but not recognise the cause	Certain delay/limit to operation
5	Up to 3 months to recover	Not detectable during operations	Could cause failure

Source: Carnegie Mellon University (2002)

The Risk priority number gain was calculated using (1) to emphasize what matter most/least in each of the operation steps

$$RPN = Severity \times Occurrence \times Detection \quad (1)$$

2.2 Data Analysis

Descriptive statistics procedure and non-parametric Chi-Square tests, at $p<0.05$, were conducted to analyze the recorded data using SPSS package. The result of the statistics tool determined the significant relationship between workers' reported hazards' risk factors and the various reported hazards suffered in connection with the task.

3. Results

3.1 Subjects Selection and Demographic Information

Two hundred and seventy-five (275) (88.7%) of the three hundred and ten (310) workers that participated in the study completed the questionnaire. The demographics of the workers are presented in Table 2. All subjects have spent not less than two (2) years on their current job with an average age of 28 years. Most of them were 32 years of age and 4years on the current job.

Table 2: Statistic information for workers studied in 23 woodwork industry

Descriptions	Age	Years of Working Experience
Mean	28	3.60
Mode	32	4.0
Std. Deviation	1.4	0.61

3.2 Reported common Work-Related Injuries

Two hundred and sixty five (265) of the 275total respondents representing 93.4% have suffered one injury or the other in the last 12months while performing their task and lasted for at least 24 hours. As presented in Figure 1, about 62% of this group of workers stated that the pains suffered kept them away from their normal duties.

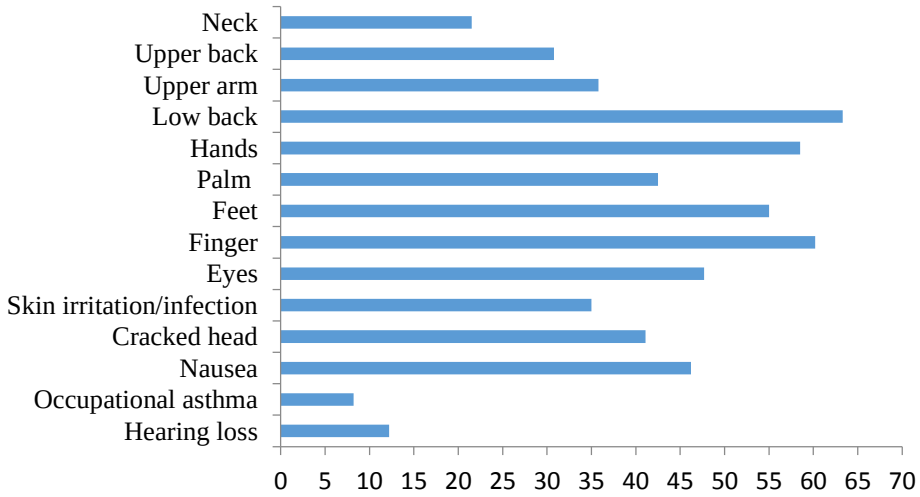

Figure 1: Woodworkers reported injury prevalence

From Figure 1, at one time or the other and in descending other, 63.3% of the workers have suffered Low Back Pain (LBP), 60.2% reportedfingers' related injuries while 55.8%, 55.1% and 42.5% reported upper arm injuries, pains in the ankle/feet andpalm injuries respectively. Other reported injuries suffered included upper back (30.8%), kneel (23.7%) and shoulder (7.5%).

3.3 Job Operations and Related Injuries

Among all the operations involved in woodworking, 70.8% of the respondents reported 'finishing operation' as mostly connected to the injury in their job (Figure 2). 63.3% reported 'hand planning' and 'scraping operation' while 57.5% reported that most injuries occurred while using nail and/or screw in 'hammering operation'. Other operations noted by workers as connected to the common injuries include; wood sorting (55%), hand sawing (52.5%), drilling (38.2%), using power tools (35%), sanding (24.2%) and chiselling (17.5%).

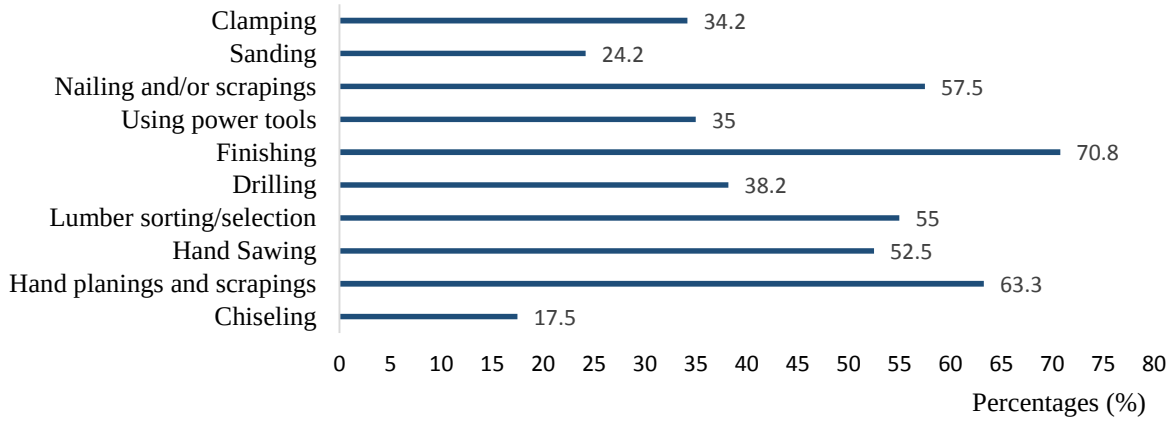

Figure 2: Woodworkers' reported job operations mostly connected to injuries

3.4 Job Risk Factors for the Injuries Prevalence

As illustrated in Figure 3, 99.2% of the workers were of the opinions that manual lifting constituted the major factor, 98.3% reported forward bending, 97.3% reported forceful gripping, 92.2% mentioned standing for long period of time, 78.6% complained they were affected by wood chips and dust as 75.4% reported exposures to harmful chemicals. Other reported risk factors include; repetitive movement (61.8%), hand twisting (55%), and poor working tools (16.2%).

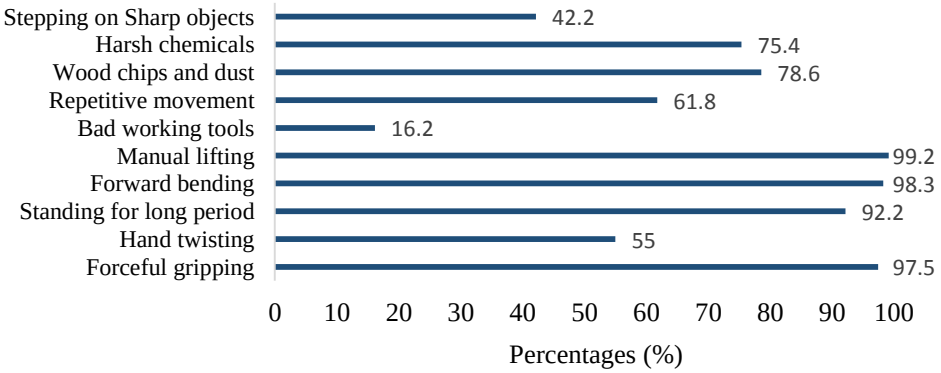

Figure 3: Woodworkers' reported job risk factors for the injuries prevalence

3.5 Test of Hypothesis

Result of non-parametric Chi-Square test for significant relationship between workers' reported hazards risk factors and the various reported injuries are shown in Table 3. Forceful gripping and hand/wrist pain; excessive dust and eye pains; forceful gripping and thumb pains; manual lifting and LBP were significant with P-values of 0.000, 0.001, 0.011 and 0.012 respectively. Therefore, relationship between there ported risk factors and the paired injuries complained by the workers exist.

However, the association between the reported: use of bad tools and hand pains; poor work environment and stepping on sharp objects were not significant (p-values were 0.201 and 0.208 respectively). Hence, the reported hand pains were not only caused by the working tools. The injury reportedly sustained as a result of stepping on sharp objects may not be caused by the reported poor work environment alone. Other factors may have contributed to the development.

Table 3: Result of non-parametric Chi-Square test conducted to ascertain the significant associations between the reported risk factors and the injuries

Risk factors descriptions	Non-parametric Chi-Square Test		
	Value	Asymp. Sig.	Decision
Forceful gripping and hand/wrist injury	95.674	0 .000	Significance
Excessive dust/chips in the work area and Eyes injury	74.467	0.001	Significance
Forceful gripping and thumb injury	66.342	0.011	Significant
Manual lifting of objects and LBPinjury	24.612	0.012	Significance
Working with bad tools and hand injury	15.621	0.201	Not Significance
Poor environment and stepping on objects' injury	1.587	0.208	Not Significant

Asymp. Sig. = Asymptotic significance

3.6 Job Safety/Hazard Analysis

3.6.1 Injury Prevalence

As observed by the JSA team (Figure 4), within the highest mark of 5 (100% or strongly prevalent) and the lowest score of 0 (0% or insignificant) attached to the presence of different job hazards possible areas and inadequacies, ten major observations were documented and rated.

3.6.2 Job Hazard/Safety Analysis for Woodworkers

Tables 4 to 11 are a partial list of the assessed task steps performed by the woodworkers. Each of the step-by-step sequence was followed by the type of risk involved, possible causes of the risk, consequences of the risk and the recommended actions to minimise the work-related hazards.

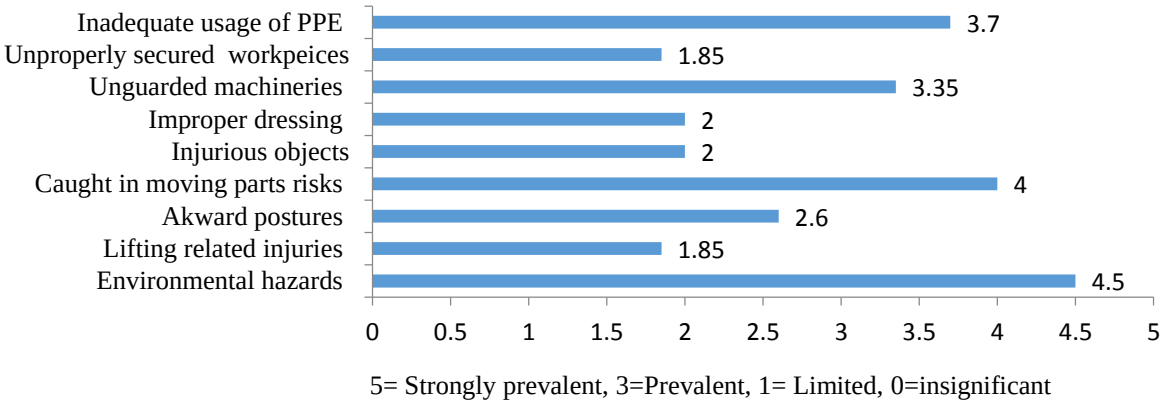

Figure 4: JSA team ratings of work-related hazards in the studied woodwork industry

Environmental hazards scored 4.5 (90% or strongly prevalent), caught in moving part risk and improper dressing were rated 4.0 (80% or strongly prevalent), inadequate usage of PPE was

allocated 3.7 marks (74% or strongly prevalent) and unguarded dangerous part of machine (67% or strongly prevalent). Others included awkward postures (52%), injurious objects on shop floor (40%) and lifting related injuries (37%).

Table 4: Risk types, causes, consequences and recommended procedures for safety in manual lumber selection and lifting/lowering task.

Operations Department: Woodworking and lifting/lowering		Job titled: Woodworker		Task: Manual wood selection
Sequence of basic job steps: 1) checking the desired lumber. 2) Lifting from stacked to point of use. 3) Lowering or placing lumber at point of use				
No.	Type of risk	Causes of Risk	Consequences of risk	Recommended procedures
A1	Dust	Wood particles	Eyes pain or poor eyesight	Dust masks should be worn
A2	Rough surface	-Rough lumber	Hand injury	Use hand gloves
A3	Weight	-Awkward lifting, -Tool heavy for the lifter	Musculoskeletal disorder, back pain, injury	-Test the weight before a lift -Lift the size you can conveniently carry, -Seek for assistance -Lift at natural posture
A4	Slip	-Improperly stackedlumbers -Heavy load	-Hand pinch injury -Kick back	-Test the weight before lifting -Seek assistance from co-workers -Select lumber from the top down the stack

Table 5: Risk types, causes, consequences and recommended procedures for safety in cutting operation with hand saw.

Operations Department: Woodworking with handsaw		Job titled: Woodworker		Task: Cutting operations
Sequence of basic job steps: 1) positioning stock on bench 2) use of hand sawon work piece3) cutting				
No.	Type of risk	Causes of Risk	Consequences of risk	Recommended procedures
B1	Wood type	Hardness	Cutting stress	-Ensure blade is well sharpened -Understand the type of plank before operation
B2	Slip	Inexperience in clamping, not tighten well, plank slip	Injury to hands and other body parts	Clamp all workpiece to preventflying out Mount the work in a vise, clamp, or special holder If slips in clamp, do not attempt to hold by hand. Stop work to retighten.
B3	Bench	Inappropriate height and condition	-MSDs, back-strain -Difficult access to point of work	-Select the right design of workbenches suitable for workers
B4	Blade	Blur blade	Impact, palm pain, kick back	-Sharpen blade before use
B5	Dust/flying chips	Wood particles	Eyes pain	-Dust masks should be worn
B6	Hand tool	Poor maintenance, poor design, Poor handling	Musculoskeletal disorder, carpal tunnel syndrome, wrist tendonitis, increased efforts at doing work	Good maintenance to reduce effort Use tools that are fit Duration of usage should be controlled Hold tools firmly in hands. Make sure the tool rest is set close to the plank.

Table 6: Risk types, causes, consequences and recommended procedures for safety in bench planning operation

Operations Department: Woodworking Job titled: Woodworker Task: Bench planning

Sequence of basic job steps: 1) positioning stock on bench A2) fixing the planner A3) using the planner on stock

No.	Type of risk	Causes of Risk	Consequences of risk	Recommended procedures
C1	Dust/ flying chips	Wood particles	Lung injury Eyes injury	use disposable respirators/ dust masks use safety glasses
C2	Skitter	Humps and valleys on work piece surface	Trauma, poor quality job.	Always clamp wood to a flat surface Properly skew the body of the plane to make plane easier to push Take a break and sharpen the plane iron
C3	Plane iron	Blur razor	Hand Injury, impact, hard planning	-Ensure plane iron is razor sharp and set the depth for a fine cut.
C4	Hard planning	Un-lubricated sole of plane	Trauma, tiredness	- Regularly oil or wax the sole of plane - Use no.4 or no.5 plane for the initial smoothing.

Table 7: Risk types, causes, consequences and recommended procedures for safety in usage of clamping devices

Operations Department: Woodworking Job titled: Woodworker Task: Clamping operations

Sequence of basic job steps: 1) positioning stock on vise 2) tightening the stock with spindle 3) working on the stock 4) untighten the workpiecefrom vise.

No.	Type of risk	Causes of Risk	Consequences of risk	Recommended procedures
D1	Flying out,	Improperly clamped before operation	Body injury from hit with stock	Clamp all work piece to prevent it from flying out Mount the work in a vice, clamp, or special holder whenever using chisels, gouges, or portable electric tools. If material slips in clamp, do not attempt to hold by hand. Shut down to retighten.
D2	Slip	Operators' hand slip	Head injury, Injury of other body parts	-Ensure full concentration while working
D3	Jaws / pinch points	Crushing	Bruises, cuts.	Keep fingers and hands out of the jaws
D4	Spindle	Distraction	Entanglement	-Do not take eyes off the vice when adjusting spindle. -Give your work your full attention -Wear appropriate, well-fitting cloth and gloves

Table 8: Risk types, causes, consequences and recommended procedures for safety in usage of basic power tools

Operations Department: Woodworking Job titled: Woodworker Task: Engaging basic power tools

Sequence of basic job steps: 1) clamping the lumber on tool bed 2) fixing tool on machine 3) switch on and off the machine 4) performing operation 5) removal of workpeice from machine.

No.	Type of risk	Causes of Risk	Consequences of risk	Recommended procedures
E1	Pinch point	Crushing	Brushes, cut, loss of finger/limb	-Proper guarding, - Wear appropriate, well-fitting cloth and gloves, -Avoid distraction
E2	Rotating blade	Unguarded parts	Cut or amputate, pierce, trap, crush body part, death	-Proper guarding, -use push sticks or avoid the need for hands to be near cutters or saw blades, -avoid distraction
E3	Rotating part	Force exerted on wood, hand feeding, too high revolution, loose-fitting gloves	Injury, trap, knock off balance, amputated body parts, death.	-Proper guarding, using a jig or push stick., use hearing protection, eye shields and dust masks, -Wear appropriate, well-fitting cloth and gloves, avoid distraction
E4	Power source	Damaged power cable, sparks, electrical shocks	Shock, burnt, trauma, fire outbreak	-Always pull out plug rather than cord from the receptacle, -Check power cable before start of operation, be observant for any electrical problems, -Ensure there is at least fire extinguisher around.

Table 9: Risk types, causes, consequences and recommended procedures for safety in hammering and screwing operations

Operations Department: Woodworking		Job titled: Woodworker		Task: Hammering operation
Sequence of basic job steps: 1) placement of nail/screw on workpeice or removal of nail 2) hammering				
No.	Type of risk	Causes of Risk	Consequences of risk	Recommended procedures
F1	Hammer head	missing punch	Hand/finger injury, thumb injury,	selecting the right hammer for the job, Focus on nail head and not the hammer. ensure well-placed nail before hammering
F2	Hammer handle	hammer head flying off	cracked head	Never use a hammer with a loose or broken handle Replace the handle if it's loose or cracked
F3	Activity	repetitive motion	repetitive strain injuries,	· Rest and take time-off work, · Proper training
F4	Nail	poor holding	Injury to thumb, finger	Grip hammer closer to the hammer head when starting a nail When holding at a start, place fingers near the top of the nail and tap lightly until it sunk into the wood enough. drill a pilot hole before hammer in a nail into hard wood
F5	Screw	twisting a screwdriver	Epicondylitis, impaired thumb and finger dexterity	-Use handgloves -Full concentration on operation -Use right type of screw for each stock

Table 10: Risk types, causes, consequences and recommended procedures for safety in sanding

Operations Department: Woodworking		Job titled: Woodworker		Task: Sanding operation
Sequence of basic job steps: 1) positioning workpeice for sanding 2) use of sand paper				
No.	Type of risk	Causes of Risk	Consequences of risk	Recommended procedures
G1	Sandpaper	Silicon Carbide	Lungs disease, Shortness of breath, wheezing and cough.	- Wear protective work clothing. -Wash thoroughly the end of the workshift
G2	*Dust*	Wood particles	Eyes pain , lung injury	Dust masks should be worn To remove sand paper dust from the wood, rub it with a tack cloth

Table 11: Risk types, causes, consequences and recommended procedures for safety in finishing/Spraying operations

Operations Department: Woodworking industry		Job titled: Woodworker		Task: Finishing and Spraying operation
Sequence of basic job steps: 1) preparing workpiece for finishing 2) operating sprayer 3) spraying 4)packing the sprayer				
No.	Type of risk	Causes of Risk	Consequences of risk	Recommended procedures
H1	hazardous substances/chemical	-Inhalation, -Offensive odour chemical reaction	-Lung injury -Trauma -Skin infection, -Burnt -Eyes injury -Nausea, - Skin irritation and rashes;	-Use material safety data sheet from the manufacturer -Check a manufacture date on the chemical before purchase. -Wear shop apron -Use Latex gloves. -Organic cartridge type respirator worn over mouth and nose - Use a nuisance mask when possible. - Wear a powered air-purifying respirator.
H2	Noise	compressed air spraying	Hearing loss, fatigue.	Use hearing protection
H3	Fire and explosion	flammable substances, buildup of dried overspray on surfaces	Burnt, death	Effective ventilation wastes should be removed from the area Fire protection measures must be in place
H4	Electricity	-Electrical sparks	Shock, burns, loss of consciousness, death	-Check power cable before start of operation, -Be observant for any electrical problems, -Ensure there is fire extinguisher around.
H5	Manual Handling	-heavy spray painting gun -awkward posture	Musculoskeletal disorders	-Test the equipment weight before lifting - Lift at natural posture
H6	Confined space	Lack of/inappropriate ventilation	inhalation of substances, skin and eyes injury	Proper design of mechanical supply fans Natural adequate air currents

3.6.3 Risk Priority Number

Risk Priority Number (RPN) assisted the JSA team to assess the priority of attention on the job analysis. The result is as shown in Figure 5. Steps of operations in D4, E2, E3, D1, D3, H1 and H3 came among the highest risks. These included flying out, rotating blade, rotating part, jaws / pinch points, spindle, hazardous substances/chemical and electricity respectively. The operations involved included clamping, engaging basic power tools and finishing/spraying.

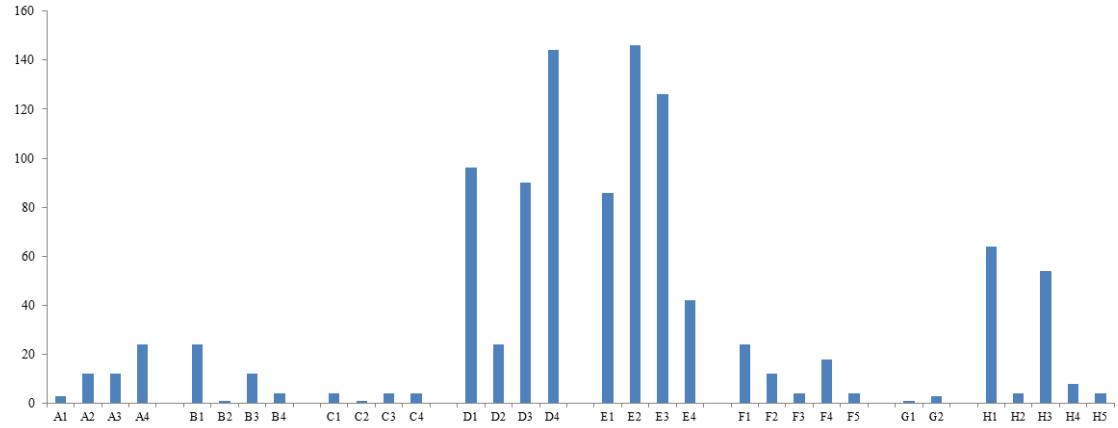

Figure 5: Risk Priority Number

3.7 Discussion

The major steps common with the cabinet making and some joinery jobs studied included manual lumber selection, lifting/lowering, cutting operation, bench planning, clamping, use of basic power tools, hammering/screwing operations, sanding and finishing/spraying operations. Each of these steps had one or more hazards attached. As reported about small and medium scale industries (Nakata *et al.*, 2006), woodworkers sustained one type of injury or the other in the process of carrying out the task. As observed and reported by the group of workers, the prevalence of work-related injury in the industry is very high. Out of the 14-reported work related injuries common with the job, 8 of them (LBP, fingers, hands, foot, eyes, nausea, palm and cracked head) were reported common by at least 40% of the workers. LBP, finger, hands and foot injuries were however reported more prevalent than others. The pattern of injuries reported by the workers were not far from the ones previously reported (Oluwatosin, *et al.*, 2015; Bamidele, *et al.*, 2011; Segun, 2010) in sawmill industry. Risks connected with the use of hazardous substance in finishing operations may be more prevalent in cabinet making job.

Eight (manual lifting, forward bending, forceful gripping, standing for long time, wood dust, harsh chemicals, repetitive movement and hand twisting) out of 10 of the total mentioned risk factors by at least 50% of the workers were notable. These risk factors may have contributed greatly to the level of injuries reported in the industry. The statistics tests conducted confirmed associations of some of the mentioned risk factors with the reported injuries. These included forceful gripping and hand/wrist injury, wood dust and hand injuries, manual lifting and LBP among other. Hence forceful gripping, as reported common in the job, contributed to the cause of the reported hand and palm injury. Excessive wood dust added to the cause of the reported eyes injury. As the manual lifting of lumber/stock also significantly lead to the reported LBP injury.

According to Pace University (2014), roughly 80% of accidents in the industries are caused by workers without the right safety attitude. To establish this view, majority of the workers analysed in this study were improperly dressed with inadequate usage of PPE. This may have also contributed to the high reported injury in the job.

Finishing, hand planning, hammering, wood sorting and hand sawing operations were notable among the operations reported, by at least 53% of the workers, as dangerous. However, in the JSA conducted, the JSA team mentioned the consequences of the risks connected with these operations. Some of these include; skin infection, musculoskeletal disorders, eyes injury, hand injury, epicondylitis, impaired thumb and finger dexterity, repetitive strain injuries, cracked head. The outcome of risk priority number gain however indicated: dust, in manual lumber selection process; slip, dust/flying ships and clamp spindle, in cutting operations; pinch point, rotating blade

and rotating parts, in the usage of power tools; hammer head and nail, in hammering operation; electricity and hazardous substances/chemical, in finishing step was considered the most hazardous risks in the job. The JSA however provided the space to identify the specific steps involved in performing the woodworking activity within the scope of the study area that may have some hazards associated with it. Measures for safe performance of each identified step that will eliminate or reduce the hazard are clearly stated.

Adequate training among the group of workers is urgently needed. This must include the basic elements such as: information on the hazards associated with a piece of equipment and/or tool so the user can anticipate risks and hazards while working with it; the necessary safety precautions that must be followed when working in each step of operation and with a particular machine or piece of equipment including the purpose and function of any guards that are in place. Shop supervisors/ managers should also be included. As mentioned by Steven (1998), managers are yet to take keen account of the risks linked with wood processing. More information are needed by administrators in the industry on the need to be responsible for providing the required PPE and enforcing its correct use.

Majority of the woodworking shops covered in this study were still in use of hand equipment. The step-by-step sequences as listed in this report are by no means an exhaustive list. It can be subjected to modifications in future research efforts.

4. Conclusion

Originating from this study, injury prevalence among the group of workers is high. Manual lifting, forward bending, forceful gripping, standing for long period of time, were the dominant risk factors reported by the woodworkers. Low back pain was the highest reported injury and followed by finger, hand, feet, eyes, nausea, palm and skin infection/irritation. The pattern of the various injuries reported among this group of cabinet making and some joinery workers however were not far from the ones previously reported by other authors in sawmill industry. Except that the risks connected with the use of hazardous substance in finishing operations may be more prevalent in cabinet making job. Among the operations mostly stated by workers as frequently causing most of the work-related injuries, finishing, hand planning and hammering were widely mentioned. The Job Safety Analysis (JSA) team rated high the risk of; environmental hazards, caught in moving parts, bruises/cuts, inhalation of substances among others. Improper dressing and inadequate usage of PPE were also noted common. Dust in manual wood selection; slip, dust/flying ships and clamp spindle in cutting operations; pinch point, rotating blade and rotating parts in the usage of power tools; hammer head and nails in hammering operation; electricity, hazardous substances/chemical in finishing operation were the most prior risks in each of the process steps and were considered as the most hazardous. The JSA team therefore provided a knowledge based tool of the likelihood of hazards connected with the various operations in the industry. The causes and consequences of the dangers with recommended procedures that will minimise and/or eradicate them were clearly highlighted. It is hopeful that adopting the recommended measures will help to sustain and/or enhance the level of occupational health and safety advocated by International Labour Organization standards.

Reference

Adeyemi, HO. Adejuyigbe, SB. Akanbi, OG. Ismaila, SO. and Adekoya, AF. 2013. Enhanced Ergonomics Training; A Requisite To Safe Body Postures In Manual Lifting Tasks. Global Journal of Researches in Industrial Engineering, 13(6): 37-42.

African Newsletter on occupational Health. 2009. Hand Safety, Accident prevention - a safe workplace. Finnish Institute of Occupational Health Finland, 19(1): 1-23.

Aruofor, RO. 2000. Review and improvement of data related to wood -products in Nigeria. EC - FAO Partnership Programme (1998-2001). Tropical forestry Budget line; 2000:B7 ‑6201/97 ‑ 15/VIII/FOR PROJECT GCP/INT/679/EC.

Bamidele, JO. Adebimpe, WO., and Dairo, MD. 2011. Pattern of hand injuries among sawmill workers in Osogbo, South-western Nigeria. Nig. Q J Hosp Med., 21(1): 64-9.

Canadian Centre for Occupational Health & Safety Job Safety Analysis, https://www.ccohs.ca/oshanswers.

Canadian Centre for Occupational Health and Safety and Human Resources Development Canada, 2016. Job Safety Analysis Made Simple, www.mtpinnacle.com, 2001.

Carnegic Mellon University. 2004. Risk Priority Number, https://resources.sei.cmu.edu.

Chao, EL. and Henshaw, JL. 2002. Job Hazard Analysis, OSHA, Occupational Safety and Health Administration, US Department of Labor. https://www.osha.gov/Publications/osha3071.html.

European Federation of Building and Woodworkers. 2015. Demographic Changes in the Woodworking Industry. www.cei-bois.org.

Judd, HM, and Janice, KW. 2004. Safety in the wood products industry, Production Journal 54(10): 8-18.

Mitchual, S. Donkoh, M., and Bih, F. 2015. Assessment of Safety Practices and Injuries Associated with Wood Processing in a Timber Company in Ghana. Open Journal of Safety Science and Technology, 5:10-19. doi: 10.4236/ojsst.2015.51002.

Nakata, A. Ikeda, T. Takahashi, MH. Minoru, HO. Naomi, GS. Anson, W. Yosei, FU. and Shunichi, AR. 2006. The prevalence and correlates of occupational injuries in small-scale manufacturing enterprises, J. Occup. Health 48: 366-376.

Occupational Safety & Health Administration. 2010. Job Safety Analysis. Michigan Department of Licensing and Regulatory Affairs, www.michigan.gov/miosha.

Oluwatosin, AA., Adeleye, AA., Olugbemiga, LA., Adenike, IO. And Saliu, TA. 2015. Awareness of Occupational Hazards and Health Problems among Sawmill Workers in Osun State, Nigeria. International Journal of Research & Review, 2(1): 1-14.

Pace University. 2014. Wood and Finishing Shop Safety Plan. https://www.pace.edu/sites/default/files/files/wood-finishing-shop-safety-plan.pdf.

Segun, RB. And Yahaya, M. 2010. Assessment of injuries in small scale sawmills industry of south western Nigeria. AgricEngInt: CIGR Journal. 12(1): 151-157.

Steven, J. 1998. Occupational health and safety problems among workers in the wood processing industries in Mutare, Zimbabwe.Economics and Management Sciences (JETEMS). 3(3): 278-285.

The Texas Department of Insurance. 2006. Division of Workers' Compensation HS02-021C(7-08). Job Safety Analysis, http://www.tdi.texas.gov.

U.S. Department of Labor Occupational Safety and Health Administration (OSHA). 1999. A Guide for Protecting Workers from Woodworking Hazards, https://www.osha.gov/Publications/osha3157.pdf.